Subdivision of the Genus Elaphoglossum

JOHN T. MICKEL and LUCÍA ATEHORTÚA G.*

The genus *Elaphoglossum* is one of the largest and most complex of fern genera. It is composed of perhaps 600 species, which frequently are difficult to distinguish. The genus has not been afforded careful study in the past. As a result, some names have been misapplied and others not used at all, and sometimes new names have been made for old species. Consequently, much herbarium material is either misidentified or unidentified. "*Elaphoglossum* is more in need of a taxonomical revision than other fern genera, all the more so as many species are imperfectly known or badly delimited in comparison with their allies." (Pichi Sermolli, 1968).

Elaphoglossum is a remarkably uniform genus of mostly simple-bladed ferns with acrostichoid sori. The veins are free (with two exceptions), the rhizomes scaly, and the blades densely scaly to nearly glabrous. The taxonomy of the genus is based to some extent on frond form and rhizome habit, but more importantly on the scales of the rhizome and blade.

Until now there has not been a useful treatment that conveniently breaks the large number of species into smaller, more coherent units. Modern keys have been made for a few areas, such as tropical Africa (Schelpe, 1969), Brazil (Alston, 1956a), Guatemala (Mickel, 1980b), Malaysia (Holttum, 1978), and India (Sledge, 1967), but these do not provide insight into treatment of the genus as a whole. The purpose of this paper is to take the first step in revising the genus by breaking it into infrageneric units that subsequently can be monographed. Even so, this treatment is provisional because a complete understanding of the genus can be had only after the species are better known.

HISTORY OF THE GENUS

Linnaeus (1753) described *Elaphoglossum crinitum* under *Acrostichum*, which included all ferns with sporangia covering the dorsal blade surface. Schott (1834) first proposed the name *Elaphoglossum*, but it was not formally described until later by John Smith (1841, p. 148), and was not widely accepted until the end of the century.

The first broad treatment of the genus was prepared by Fée (1845) under *Acrostichum*. He divided the elaphoglossoids into two groups, Oligolepideae and Polylepideae. These in turn were subdivided on the basis of frond size and scale characters. Later, Fée (1852) used four primary groups without further subdivision: Oligolepideae, Polylepideae, Pilosellae, and Chromatolepideae.

Moore (1857–1862) was the first to use the genus name *Elaphoglossum* extensively; he made many new combinations under it. He utilized a generic breakdown of Oligolepidum ("fronds naked, or with but few scales") and Polylepidum ("fronds clothed with numerous scales"). Sodiro (1897, under *Acrostichum*) used more group names (Glabra, Setosa, Oligotrichia, Polytrichia, Squamosa, Oligolepidia, Laciniata, Polylepidia), but without designating nomenclatural rank.

---

*New York Botanical Garden, Bronx, NY 10458.

Diels (1899) made two sections of the genus: *Eu-Elaphoglossum* for the bulk of the species and *Hymenodium* for the distinct, broad, net-veined *E. crinitum*. His informal subsectional groups largely followed those of Sodiro.

In the same year, Christ (1899) published his classic *Monographie des Genus Elaphoglossum*, which stands as the most detailed treatment of the genus, covering 142 species (and numerous synonyms) in 32 groups. The primary division was based on venation: ordo *Stenoneura* with veins running all the way to the margin without thickened vein ends and ordo *Condyloneura* with veins ending just short of the margin with swollen vein ends (hydathodes). Christ further subdivided these into sections, subsections, and divisions, using characters such as blade scales, frond size, stipe articulation, and rhizome habit and thickness. Basically, his species groups were natural and recognizable (nearly all of our ultimate divisions are based on them). Unfortunately he placed what we believe to be unrelated divisions and subsections together and did not provide a usable key to the groups. For example, Christ placed some of the species with black, marginal, subulate scales in each of the two ordos, when in fact they are very closely related and none shows the hydathodes of ordo *Condyloneura*. By the same token, his subsections *Dimorpha, Petiolosa, Pilosa*, and *Ovata* in *Condyloneura* show no signs of hydathodes and belong with close relatives in ordo *Stenoneura*. This is not to say that hydathodes are a poor character; we would have adopted Christ's two ordos as subgenera were it not for misgivings about possible convergent evolution of subulate scales and hydathodes or lack thereof.

As generally accepted, the species of *Elaphoglossum* have narrowly elliptic, undivided fronds, but several species of elaphoglossoid affinity with divided fronds are known. Several small, flabellately divided species were first generically segregated by Link (1841) as *Peltapteris* and pinnately divided plants by Presl (1851) as *Microstaphyla*. Although some of the American species had the pinnate form of *Microstaphyla* and had been placed in that genus, Gómez (1975) saw that their true relationship was with *Peltapteris*. He left only the type species (from St. Helena) in *Microstaphyla*. One large, pedately divided species, *E. cardenasii*, was described from Bolivia by Wagner (1954); strangely, no one has proposed a separate genus for it. Christ placed the species of *Peltapteris* (as *Rhipidopteris*) and *Microstaphyla* under *Elaphoglossum* and, after showing that frond architecture was the sole character for distinguishing these groups from species of *Elaphoglossum*, Mickel (1980a) concurred in keeping them all in *Elaphoglossum*.

RELATIONSHIPS OF THE GENUS

The relationships of the elaphoglossoid ferns to other ferns are unclear. *Elaphoglossum* is placed close to the lomariopsid genera by some authors because of the acrostichoid sori, largely epiphytic habitat, monolete spores, and chromosome number of $x=41$. Holttum (1947) placed it in the Lomariopsidoideae of his Dennstaedtiaceae, and Alston (1956b) placed it in the Lomariopsidaceae. Crabbe, Jermy, and Mickel (1975) placed it in the Elaphoglossoideae of the Aspleniaceae and close to the Lomariopsidoideae. Pichi Sermolli (1968) pointed out the distinctness of the group from the lomariopsids and erected a new family for it, the

Elaphoglossaceae, but placed this next to the Lomariopsidaceae. Christensen (1938) gave it its own subfamily Elaphoglossoideae in the Polypodiaceae, but could not determine its relationship with certainty.

Sporne (1975) and Holttum (1947) have suggested a davallioid relationship because of similarities of stele and chromosome number. We have found some spores which closely resemble those of *Bolbitis appendiculata* of the lomariopsids (Hennipman, 1977, pl. 4). Many other spores are similar to those of various species of *Oleandra* and *Arthropteris* (illustrated by Liew, 1977). This is especially interesting because *Oleandra*, like *Elaphoglossum*, has simple blades, straight, free veins, phyllopodia, hydathodes, and chromosome number of $x=41$.

MORPHOLOGICAL CHARACTERS

Rhizome habit.—Most species have short-creeping rhizomes, but they range from moderately to long-creeping and from ascending to erect, and are 1–12 mm in diameter. Members of a single subsection usually have a similar rhizome habit, but the entire spectrum can be found within subsection *Pachyglossa*.

Aerophores.—*Elaphoglossum* aerophores are pale, aerenchymatous outgrowths from the lenticel line on the stipe base or adjacent rhizome, one on each side of the stipe. They may appear as fleshy wings about 1 mm broad along the phyllopodia or as tongue-shaped emergences from the stipe base or adjacent rhizome. They are not conspicuous on dried specimens, especially in those species with fasciculate fronds, which makes a survey based on herbarium material difficult. Lloyd (1970) made a study of living specimens in Costa Rica and found aerophores in 92% of the species studied. More extensive systematic and morphological study of this structure is needed.

Phyllopodia.—These dark, sclerified stipe bases are not found in all species and are concentrated in a few subsections, particularly those with coriaceous, subglabrous fronds (esp. subsects. *Pachyglossa* and *Huacsaro* and sect. *Amygdalifolia*). Pichi Sermolli (1968) distinguished *Peltapteris* from *Elaphoglossum* on the basis of the former's lacking phyllopodia, but *Peltapteris*' closest relatives, which are in *Elaphoglossum* sect. *Squamipedia*, also lack them. Most sections or subsections either lack phyllopodia or have them only poorly developed.

Frond size.—Christ (1899) distinguished some of his glabrous sections by frond size. To some extent this is valid. Section or subsection members are consistently approximate in size. Subsections may have small and medium fronds or medium and large fronds, but generally not both small and large, although there are diminutive specimens of nearly all species. There are also very long individual specimens in groups with normally medium-sized fronds (e.g., *E. vestitum* to 1.7 m long and *E. herminieri* to 2 m long).

Blade shape.—Although the blades are basically simple and unlobed, there is some variation in form. They are fairly uniformly ovate-elliptic in the *E. lindenii* complex (subsect. *Setosa*), lanceolate with an obtuse apex in subsect. *Muscosa*, narrowly elliptic with an obtuse apex in subsect. *Huacsaro*, and linear-elliptic in subsect. *Eximia*. Blade shape seems to be more consistent in species groups or series than in sections or subsections.

Venation.—*Elaphoglossum* fronds are basically free-veined. *Elaphoglossum crinitum* has net venation and has been set aside as the genus *Hymenodium* by some authors, but *E. crassifolium*, which also has net venation, does not seem to be closely related. *Elaphoglossum decoratum* has an occasional anastomosis, and in several species the vein endings are laterally extended and even fused occasionally (e.g., *E. acutissimum*) to form a commissural vein. In most species the veins diverge from the midvein and go to the margin at an angle of 70–80°. In several sections (esp. *Undulata, Setosa, Eximia,* and *Amygdalifolia*), they diverge at a narrower angle (40–60°), are farther apart (ca. 2 mm), and terminate about 1 mm short of the margin, often ending in a round thickening or hydathode. Apparently in all species the veins end slightly short of the margin, but in many species the blade is coriaceous with slightly recurved margins, making the actual vein endings difficult to distinguish. Therefore, some authors (including Christ) have claimed that the veins go to the margin.

Hydathodes.—The veins in the blade generally end near the margin and are at least slightly swollen. In certain groups, the veins end 1–2 mm short of the margin and are greatly enlarged to form hydathodes. Whether these function differently from those not enlarged is not known. Hydathodes are found in all species of sects. *Setosa, Eximia, Undulata*, and *Amygdalifolia*, and are not known from any species of the other sections. These sections comprise what Christ designated ordo *Condyloneura*. We do not recognize these as subgenera here because it is unclear whether there are close relationships between members of the two ordos, as perhaps between sects. *Setosa* (with hydathodes) and *Polytrichia* (lacking them).

Blade texture.—Among members of a subsection and closely related groups, texture seems to be nearly uniform. Coriaceous fronds generally are nearly glabrous, but whether all species with such fronds are related is questionable. The absence of blade scales makes it difficult to assess relationships. Most species have herbaceous to firm laminae, but those with hydathodes are usually thin.

Rhizome scales.—The rhizomes are generally densely scaly, with linear, lanceolate, ovate, or rarely even round scales, which are attached at a cordate to peltate base. Scale color ranges from bright orange to maroon, brown, or black. Texture varies from thin to sclerotic. Scale margins in most species are entire or have weak teeth, but in sect. *Lepidoglossa* they often are fringed with slender, hair-like teeth. Differences in cell patterns have not yet been examined systematically, but probably will be helpful taxonomically. In some groups within sect. *Elaphoglossum*, the rhizome scales may be deciduous, leaving in some cases completely glabrous creeping rhizomes. In a few species the naked rhizome is black and glutinous.

Blade scales.—There is great diversity in scale morphology, but the blade scales are basically lanceolate. They may be erose-margined (*E. muscosum*), entire (*E. decoratum*), or deeply ciliolate-toothed (subsect. *Polylepidea*). Some are so deeply ciliolate-toothed there is barely any scale body (*E. vestitum*) or are reduced to stellate hairs (*E. pilosum*). In *E. tectum*, the stipe and upper blade scales are round-peltate with erose margins, whereas those of the lower blade surface are stellate hairs. In *E. petiolatum*, *E. huacsaro*, and their relatives, the blade scales are further reduced to resinous dots. Coriaceous, subglabrous groups often have reduced, minute, black, linear or stellate blade scales.

There are no multicellular hairs in *Elaphoglossum*; those thought to have hairs (sects. *Setosa* and *Polytrichia*) have in reality hair-like subulate scales which are linear-lanceolate with inrolled margins. It is not clear whether all groups with subulate scales are related or not. Although they have distinctive, minute, glandular hairs in common, they differ in their spores.

Stipe scales.—They are like those of the rhizome at the base and like those of the blade near the apex. Sometimes these are transitions from one to the other type, but in other cases, two distinct types are intermixed.

Glandular hairs.—Minute, erect, unicellular, gland-tipped hairs are located on the stipe in sects. *Polytrichia, Setosa*, and *Eximia*. Their presence seems to be correlated with the presence of subulate scales. In subsect. *Apoda,* these hairs also are found on the blade surface.

Fertile fronds.—In most species, the fertile fronds have narrower and shorter blades and proportionally longer stipes than the sterile ones. The fertile fronds may be longer, essentially equal, or noticeably shorter than the sterile ones. The relationship does not seem to be consistent in whole sections or subsections, but is so in species groups or occasionally in subsections (fertile longer in subsects. *Huacsaro* and *Pilosa*).

In some species, the fertile frond is folded in half lengthwise along the midvein until maturity. This conduplicate fertile blade is found in *E. lindenii* and *E. piloselloides* of sect. *Setosa*, but not in all species of the section; in subsect. *Petiolosa*, both species show this condition.

The indument of the fertile frond generally is the same on the upper surface as on that of the sterile blade. However, there are a few species that have scales on the lower surface among the sporangia, and their presence is especially noteworthy. It is not consistent with subsections, occurring in *E. villosum, E. muscosum, E. siliquoides*, all of different subsections, but seems to be common to all members of subsect. *Plumierana*.

In certain species, there seems to be a conspicuous sterile margin, that forms a pale border 1–2 mm wide outside the sporangial mass. It is especially noticeable in some thin-textured species such as *E. albomarginatum*. Although it is not readily apparent in most other species, close examination shows that the sterile margin is underrolled and thus concealed. Probably some sort of sterile margin exists in most or all species, which is to be expected since the veins do not reach the margin.

Spores.—*Elaphoglossum* spores usually have been described as having narrow crests with minute spicules on the surface (Erdtman, 1957, based on *E. vieillardii* from New Caledonia), but our survey of spores using the scanning electron microscope has shown considerable variation within the genus. We have examined 163 species, including representatives of all sections and subsections. *Figures 1–18* are based on specimens in the New York Botanical Garden herbarium.

Spores of most species have slender crests or low folds or ridges. Section *Squamipedia* (*Fig. 7*) also has low ridges, but the entire surface is densely ornamented with distinctive spicules found also in the flabellately or pinnately divided subsect. *Peltapteris*. High slender crests are found in sects. *Amygdalifolia*, *Decorata*, and in some members of sects. *Setosa* and *Elaphoglossum*. Subsection *Pachyglossa*, probably the largest in the genus, displays several different spore types: some species have tall, nearly spine-like, smooth or perforated crests, to highly fenestrated, lace-like crests; others have long, slender crests lacking holes; and others have low, broad ridges.

Spores with low, broad ridges are found in sects. *Lepidoglossa* (*Fig. 9*), *Polytrichia* (*Fig. 12*), and part of sect. *Elaphoglossum* subsect. *Pachyglossa* (*Fig. 3*). The ridges tend to be short (*Figs. 9* and *12*) rather than elongate, and often have small verrucae in the valleys between the ridges, which suggests a possible relationship among these groups. On the other hand, the lack of other ornamentation could indicate either a common or a primitive spore type or a condition arrived at independently. Correlations of additional characters are needed to resolve this.

Spores of subsect. *Muscosa* are unique in having verrucate surfaces (*Fig. 11*).

The spores of sects. *Eximia*, *Undulata*, and part of sect. *Setosa* subsect. *Setosa* lack ridges or crests of any sort. Instead, they have a dense covering of short spines which branch at the base to form a reticulum (*Figs. 14* and *16–18*). In sect. *Undulata*, the spines occasionally fuse to form small crests (*Fig. 18*). In *E. beaurepairii* (sect. *Eximia*, *Fig. 17*) the reticulum is very open, whereas in sect. *Setosa* subsect. *Setosa* (*E. crinipes et aff.*) the branches often fuse laterally to make a more dense covering on the spore surface (*Fig. 14*). Spores of some members of subsect. *Setosa* (*E. lindenii et aff.*) and *Alpestria* have low, slender crests which often have holes of various sizes in them (*Fig. 13*), somewhat like those mentioned for subsect. *Pachyglossa*. Holes also occur in the spore surface, which in some cases resembles somewhat the spore surface reticulum of sects. *Undulata* and *Eximia*. Perforations, at least in the body of the spore, also are found in some species of subsect. *Pachyglossa*, but whether this indicates a relationship has not yet been determined.

Not every species fits into the spore pattern for its group. Some species of subsect. *Pilosella* have holes in the surface and others do not. In subsect. *Plumierana*, *E. buchii* (*Fig. 15*) and *E. plumieri* have solid crests, whereas the morphologically similar *E. lanceum* has highly fenestrated crests. In general, however, spore morphology has been quite useful in confirming relationships presumed on other grounds and in suggesting new phyletic interpretations.

CONSPECTUS OF THE GENUS ELAPHOGLOSSUM (INCLUDING CHRIST'S INFRAGENERIC GROUPS IN PARENTHESES)

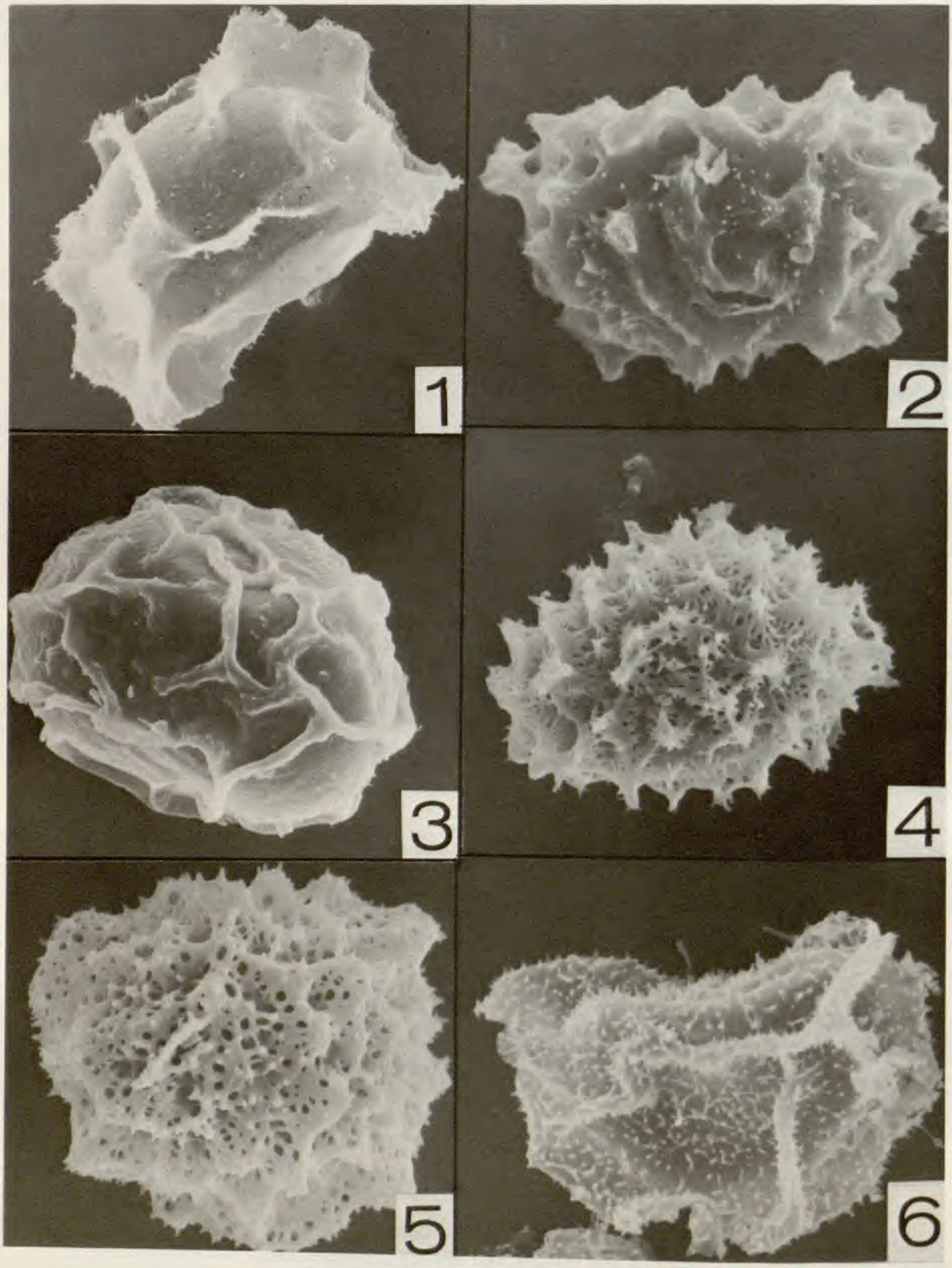
sect. *Elaphoglossum* (sect. *Craspedoglossa*)
  subsect. *Pachyglossa* Christ (subsect. *Pachyglossa* div. *Conformia*, including type of genus; subsect. *Platyglossa* div. *Latifolia*; subsect. *Flaccida* by type but not by description or other included species; subsect. *Herminieriana*)
  subsect. *Tenuifolia* Mickel & Atehortúa (subsect. *Flaccida* by description and included species but not by type)

- sect. *Squamipedia* Mickel & Atehortúa
  - subsect. *Squamipedia* Mickel & Atehortúa (subsect. *Pachyglossa* div. *Squamipedia*)
  - subsect. *Peltapteris* (Link) Mickel & Atehortúa (subsect. *Pachyglossa* div. *Rhipidopteris*)
  - subsect. *Ovata* Christ
  - subsect. *Feeana* Christ
- sect. *Decorata* Mickel & Atehortúa (subsect. *Platyglossa* div. *Decorata*)
- sect. *Lepidoglossa* Christ (sect. *Gymnoglossa*)
  - subsect. *Polylepidea* Christ (subsect. *Polylepidea* div. *Auricoma*)
  - subsect. *Microlepidea* Christ (subsect. *Microlepidea* div. *Tecta*)
  - subsect. *Pilosa* Christ (subsect. *Pilosa* div. *Grata*; subsect. *Microlepidea* div. *Viscosa*; subsect. *Polylepidea* div. *Stipitata*; subsect. *Dimorpha*)
  - subsect. *Petiolosa* Christ
  - subsect. *Huacsaro* Mickel & Atehortúa
  - Subsect. *Muscosa* Mickel & Atehortúa (subsect. *Polylepidea* divs. *Muscosa* and *Bellermanniana*)
- sect. *Polytrichia* Christ
  - subsect. *Hymenodium* (Fée) Christ
  - subsect. *Hybrida* Christ (subsect. *Platyglossa* div. *Melanolepidea*; subsect. *Hybrida* by type and description but not by other included species)
  - subsect. *Apoda* Mickel & Atehortúa
- sect. *Setosa* (Christ) Mickel & Atehortúa
  - subsect. *Setosa* Christ
  - subsect. *Pilosella* Christ
  - subsect. *Alpestria* Mickel & Atehortúa
  - subsect. *Plumierana* Mickel & Atehortúa
- sect. *Eximia* Mickel & Atehortúa
  - subsect. *Eximia* Mickel & Atehortúa (subsect. *Hybrida* by included species but not by type or description)
  - subsect. *Cardenasiana* Mickel & Atehortúa
- sect. *Undulata* Christ
- sect. *Amygdalifolia* (Christ) Mickel & Atehortúa

The following of Christ's groups are of unknown relationship: subsect. *Glossoides,* subsect. *Coespitosa,* subsect. *Pachyglossa* div. *Micradenia,* subsect. *Polylepidea* div. *Argyrophylla,* subsect. *Polylepidea* div. *Fimbriata*, subsect. *Pilosa* div. *Boraginea*, and subsect. *Pilosa* div. *Gardneriana*.

KEY TO THE SECTIONS OF ELAPHOGLOSSUM

1. Veins ending short of the margin, enlarged at the tip to form generally conspicuous hydathodes.
  2. Rhizome long-creeping; blade glabrous; phyllopodia present, but short. ......sect. *Amygdalifolia*
  2. Rhizome short- to long-creeping; blade scaly, only rarely glabrous; phyllopodia lacking.
    3. Blade linear-elliptic or pedately divided; blade scales very small, dark, lanceolate, not subulate. sect. *Eximia*
    3. Blade narrowly elliptic or ovate-lanceolate; blade scales subulate or cordate-lanceolate, pale.
      4. Blade scales subulate. ....sect. *Setosa*
      4. Blade scales cordate-lanceolate, erose or toothed. ....sect. *Undulata*
1. Veins ending at or very close to the margin, not ending in hydathodes.
  5. Blade glabrous or subglabrous.
    6. Rhizome long-creeping, fronds very small (2–20 cm long), usually lacking phyllopodia; blade simple to finely dissected. ....sect. *Squamipedia*
    6. Rhizome erect or short- to long-creeping; fronds small to large (12–200 cm long), phyllopodia distinct or indistinct but always present. ....sect. *Elaphoglossum*



FIGS. 1–6. Spores of *Elaphoglossum* sect. *Elaphoglossum*. FIG. 1. *E. pteropus (Brade 19180)*, × 1200. FIG. 2. *E. conforme (Murray s.n.)*, × 1200. FIG. 3. *E. dussii (Broadway s.n.)*, × 1200. FIG. 4. *E. acutifolium (Brade 5358)*, × 1200. FIG. 5. *E. bicolor (Wacket 121)*, × 1560. FIG. 6. *E. wacketii (Wacket 7849)*, × 1080.

5. Blade scaly.
  7. Blade scales subulate. ....sect. *Polytrichia*
  7. Blade scales lanceolate, reniform, round-peltate, or stellate, not subulate.
    8. Blade scales only at frond margin and along midvein. ....sect. *Decorata*
    8. Blade scales not restricted to frond margin and midvein......................sect. *Lepidoglossa*

21586 Elaphoglossum sect. Elaphoglossum

25870 Sect. *Craspedoglossa* Christ, Monogr. Elaph. 20. 1899.

Rhizome long- to short-creeping or suberect; rhizome scales linear to lanceolate; phyllopodia distinct or indistinct; blade glabrous or subglabrous, coriaceous to very thin; hydathodes lacking; blade scales minute, laciniate-pectinate to stellate; spores with various forms of crests or low ridges.

TYPE SPECIES: *Acrostichum conforme* Swartz [≡ *Elaphoglossum conforme* (Swartz) Schott ex J. Smith].

KEY TO THE SUBSECTIONS OF SECT. ELAPHOGLOSSUM

1. Blade coriaceous; veins obscure; phyllopodia conspicuous........................subsect. *Pachyglossa*
1. Blade very thin, translucent; veins evident; phyllopodia inconspicuous...........subsect. *Tenuifolia*

21585 Elaphoglossum subsect. Pachyglossa Christ, Monogr. Elaph. 20. 1899. 7188

25871 Subsect. *Platyglossa* Christ, Monogr. Elaph. 20. 1899. LECTOTYPE (chosen here): *Acrostichum latifolium* Swartz [≡*Elaphoglossum latifolium* (Swartz) J. Smith]. Christ did not designate a type species for this subsection, but chose *E. latifolium* as the type of his first and most typical division, *Latifolia*.

25872 Subsect. *Flaccida* Christ, Monogr. Elaph. 20. 1899.

Subsect. *Herminieriana* Christ, Monogr. Elaph. 21. 1899.

Characters of the section, with the blade coriaceous and the phyllopodia especially distinct.

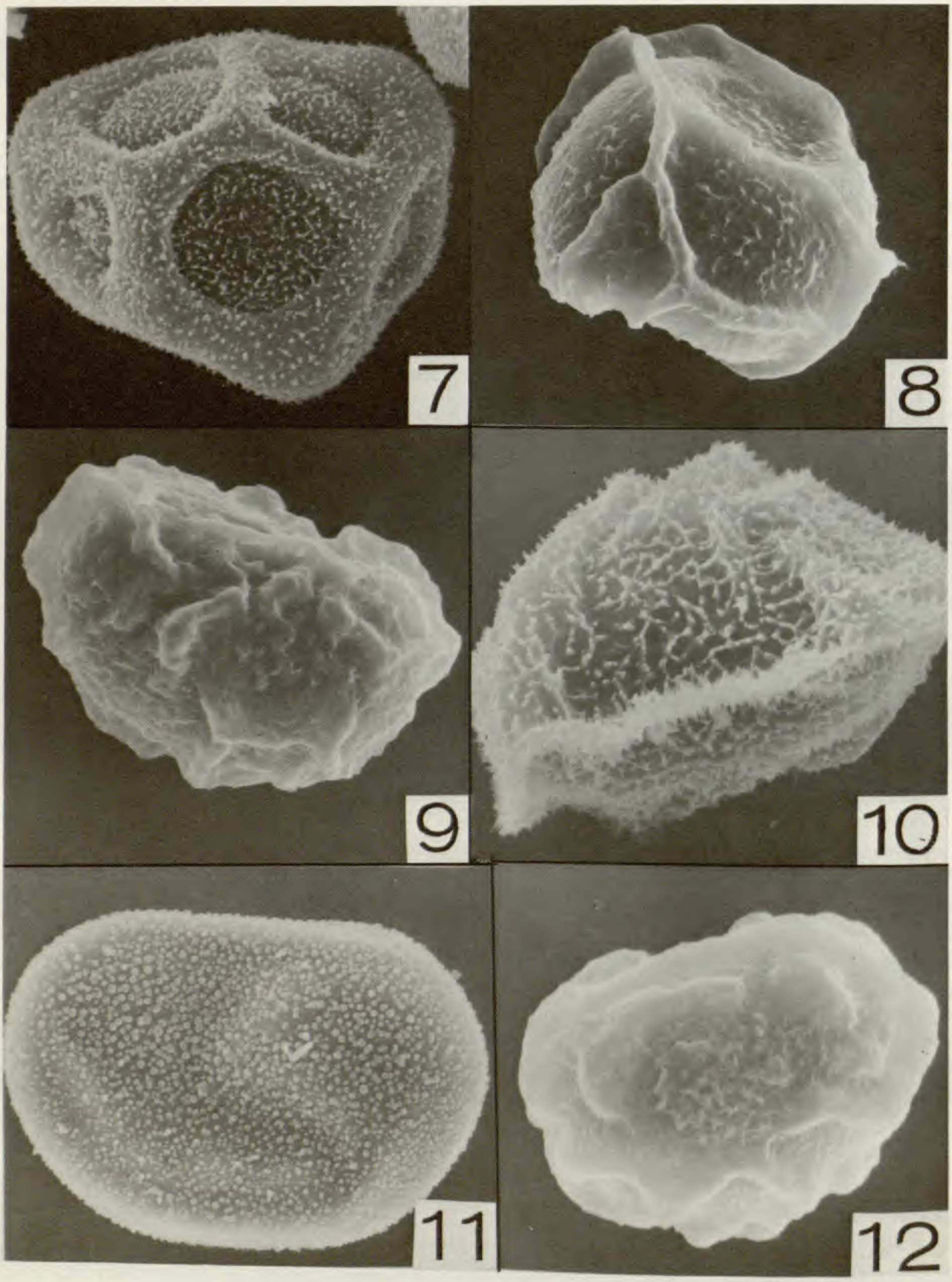
TYPE SPECIES: *Acrostichum conforme* Swartz [≡*Elaphoglossum conforme* (Swartz) Schott ex J. Smith]. 10930

SELECTED SPECIES EXAMINED:

Elaphoglossum acrostichoides (Hook.) Schelpe, *E. acutifolium* Rosenst., *E. affine* (Mart. & Gal.) Moore, *E. angulatum* (Blume) Moore, *E. angustatum* (Schrad.) Hieron, **E. bicolor* Rosenst., *E. callifolium* (Blume) Moore, *E. chartaceum* (Baker) C. Chr., *E. crassifolium* (Gaud.) Anderson & Crosby, *E. crassinerve* (Kunze) Moore, **E. funckii* (Fée) Moore, **E. gayanum* (Fée) Moore, *E. glabellum* J. Smith, *E. glaucescens* Rosenst., *E. glaucum* (Fée) Moore, **E. glossophyllum* Hieron., *E. guatemalense* Klotzsch, *E. herminieri* (Bory & Fée) Moore, *E. hoffmannii* (Mett.) Hieron, *E. hymenodiastrum* (Fée) Brade, *E. inaequalifolium* (Jenm.) C. Chr., *E. latifolium* (Swartz) J. Smith, *E. leptophyllum* (Fée) Moore, **E. lingua* (Presl) Brack., *E. longifolium* (Presl) J. Smith, *E. maxonii* Underw. ex Morton, *E. pteropus* C. Chr., *E. rigidum* (Aubl.) Urban, *E. schiffneri* Christ, *E. schomburgkii* (Fée) Moore, *E. simplex* (Swartz) J. Smith, *E. sporadolepis* (Kunze) Moore, *E. tenuifolium* (Liebm.) Moore, *E. tovarense* (Moritz ex D. C. Eat.) Moore, *E. tuckerheimii* Brause, **E. vagans* (Mett.) Hieron., and *E. wawrae* (Luerss.) C. Chr.

This is the largest and taxonomically most complex subsection of the genus. There are relatively few available diagnostic characters, and the variation within and between species is difficult to interpret. Several groups are vaguely discernible, but whether they are all closely allied or have evolved to the coriaceous, glabrous condition independently is still in question. We have refrained from distinguishing taxonomic groups until more information is gathered.

One group has very short to suberect, stout (4–12 mm diam.) rhizomes and spores with many short crests that resemble broad spines (*Fig. 2*). In some of



FIGS. 7–12. Spores of *Elaphoglossum*. Sect. *Squamipedia*. FIG. 7. *E. squamipes (Wurdack 692)*, × 840. FIG. 8. *E. ovatum (Grubb 540)*, × 1200. Sect. *Lepidoglossa*. FIG. 9. *E. paleaceum (MacBride 4301)*, × 1560. FIG. 10. *E. huacsaro (Acosta-Artega 165)*, × 1200. FIG. 11. *E. bellermannianum (Camp E 3938B)*, × 960. FIG. 12. *E. auripilum (Mickel 2657)*, × 1800.

these there are perforations in the crests and in the spore surface as well (*Figs. 4* and *5*). On the other hand, some species (e.g., *E. pteropus*) have spores with tall, slender, solid crests (*Fig. 1*).

Many species have more slender rhizomes (2–4 mm diam.) that have dark, sclerotic rhizome scales which may become deciduous, as in *E. guatemalense* and *E. glabellum*. These have spores with low, broad ridges (*Fig. 3*).

There is a species complex, including *E. affine, E. tenuifolium, E. leptophyllum*, and *E. schiffneri*, which has ovate-lanceolate, orange to tan rhizome scales with varying degrees of dark, sclerotic streaks in them. Their rhizomes range from short-creeping to rather long-creeping. Quite possibly this complex is related to what looks like a distinct group with very long-creeping, slender, cord-like rhizomes with black, ovate-lanceolate rhizome scales (species marked with an asterisk in the above list). *Elaphoglossum hoffmannii* has the most slender, nearly naked rhizomes and smallest fronds of the group and may not belong here.

Elaphoglossum subsect. Tenuifolia Mickel & Atehortúa, subsect. nov.

Rhizomata gracilia, saepe nuda; phyllopodia inconspicua; lamina angusta tenuissima; nervi visibiles; sporae dense spiculatae cristatae.

TYPE SPECIES: *Elaphoglossum acutissimum* Christ. - 7166

SELECTED SPECIES EXAMINED:

Elaphoglossum burchellii (Baker) C. Chr., *E. gramineum* (Jenm.) Urban, *E. praelongum* (Fée) C. Chr., *E. sherringii* (Baker) C. Chr., and *E. wacketii* Rosenst.

This group is distinct in its very thin-textured blades and often naked or even black and glutinous rhizome. The glabrousness of the blade induces us to place these species in sect. *Elaphoglossum*, but they may well belong elsewhere, perhaps nearer to subsect. *Pilosa*. At least one member of this group has resinous dots on the dorsal surface of the blade and spiculate spores (*Fig. 6*), such as are found in *E. huacsaro* (*Fig. 10*) in subsect. *Huacsaro* and in some members of subsect. *Pilosa*, but the naked rhizome and glabrous blade resemble subsect. *Pachyglossa*.

Elaphoglossum gramineum has a glabrescent rhizome and resin-dotted blade, but the blade is coriaceous, unlike that of other members of this subsection.

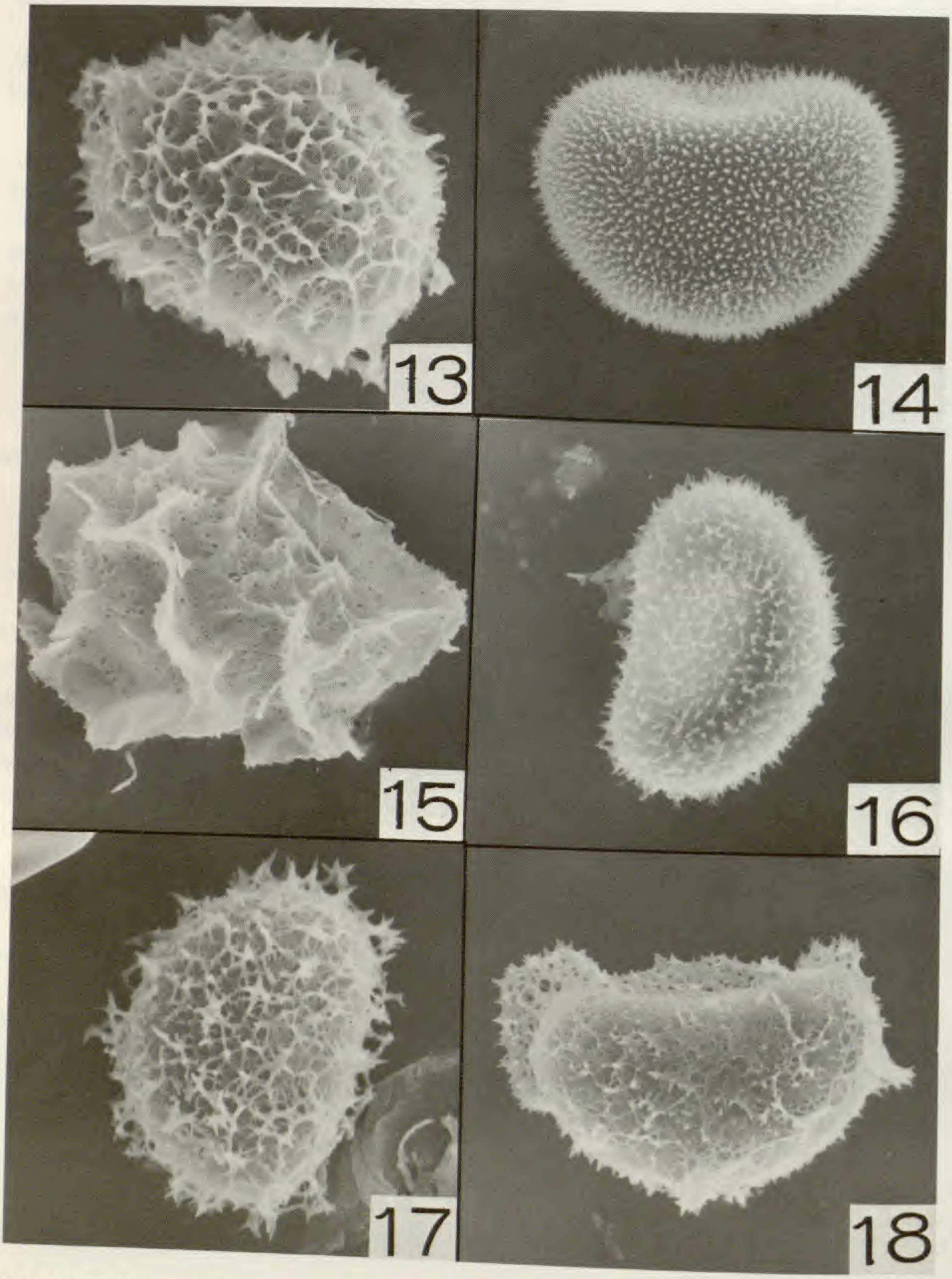
Subsection *Flaccida* was intended by Christ to include the thin-bladed species we treat as subsect. *Tenuifolia*, but unfortunately he selected as type *E. flaccidum*, which generally is regarded today as a synonym of *E. rigidum*, a member of the coriaceous subsect. *Pachyglossa*.

Elaphoglossum sect. Squamipedia Mickel & Atehortúa, sect. nov.[2]

Rhizomata gracillima longe repentia; rhizomatis stipitisque paleae ovato-lanceolatae peltatae, vel lacerato-pectinatae; phyllopodia rara; lamina parva; laminae paleae parvae fuscae reductae, saepe hastatae; nervi inconspicui; hydathodi nulli; sporae plerumque multispiculatae cristis demissis latis anastomosantibus ornatae.

---

[2] Although the sectional names *Squamipedia, Setosa*, and *Eximia* repeat subsectional names, Latin diagnoses are given for both levels since at the subsectional level there are no automatic tautonyms nor type subsections, and some botanists might not construe the subsectional names as properly described without separate Latin diagnoses.



FIGS. 13–18. Spores of *Elaphoglossum*. Sect. *Setosa*. FIG. 13. *E. moritzianum (Fendler 362)*, × 1440. FIG. 14. *E. crinipes (Standley 85982)*, × 1200. FIG. 15. *E. buchii (Jenman. s.n.)*, × 1200. Sect. *Eximia*. FIG. 16. *E. eximium (Mickel 3417)*, ×1080. FIG. 17. *E. beaurepairei (Brade 20937)*, × 1200. Sect. *Undulata*. FIG. 18. *E. hirtum (Mickel 2978)*, ×1200.

r-7211

TYPE SPECIES: *Acrostichum squamipes* Hook. [≡*Elaphoglossum squamipes* (Hook.) Moore].

KEY TO THE SUBSECTIONS OF SECTION SQUAMIPEDIA

1. Stipe scales deeply lacerate-pectinate .... subsect. *Ovata*
1. Stipe scales entire, ovate-lanceolate.
  2. Sterile blade pinnately or flabellately divided, rarely undivided but then broadly flabellate. subsect. *Peltapteris*
  2. Sterile blade entire, linear-elliptic or oblanceolate.
    3. Blade margin crenulate; blade thin; spores with narrow crests .... subsect. *Feeana*
    3. Blade margin entire; blade coriaceous; spores with low folds or ridges and many spicules. subsect. *Squamipedia*

25874 **Elaphoglossum subsect. Squamipedia Mickel & Atehortúa, subsect. nov.**[3]

Rhizomatis stipitisque paleae ovato-lanceolatae peltatae integrae; lamina simplex; sporae spiculatae (*Fig. 7*).

✓TYPE SPECIES: *Acrostichum squamipes* Hook. [≡*Elaphoglossum squamipes* (Hook.) Moore].

OTHER SPECIES EXAMINED:

Elaphoglossum cardiophyllum (Hook.) Moore, *E. craspedariiforme* (Fée) Brade ex Alston, *E. deltoideum* (Sod.) Christ, *E. lloense* (Hook.) Moore, and *E. revolutum* (Liebm.) Moore.

This is one of the most distinctive groups in the genus, with its small fronds, broadly ovate rhizome and stipe scales, and lack of phyllopodia. In blade form *E. cardiophyllum* seems to belong here, but phyllopodia are present and spore spicules are lacking. This subsection is extremely closely related to subsect. *Peltapteris* and agrees in all characters except frond architecture.

25877 **Elaphoglossum subsect. Peltapteris (Link) Mickel & Atehortúa, stat. nov.**

Peltapteris Link, Fil. Sp. Hort. Reg. Bot. Berol. Cult. 147. 1841.

Rhipidopteris Schott ex Fée, Mém. Fam. Foug. 2: 14. 1845, nom. illeg.

Similar to subsect. *Squamipedia*, but the sterile blade pinnately or flabellately divided, rarely undivided but flabellate.

TYPE SPECIES: *Osmunda peltata* Swartz [≡*Elaphoglossum peltatum* (Swartz) Urban].

OTHER SPECIES EXAMINED:

Elaphoglossum columbianum (Maxon) Mickel, *E. moorei* (E. Britt.) Christ, *E. peruvianum* (Gómez) Mickel, and *E. tripartitum* (Hook. & Grev.) Mickel.

This group is usually treated as a distinct genus (Gómez, 1975; Morton, 1955), but can be distinguished from species of subsect. *Squamipedia* only by the frond dissection.

25878 **Elaphoglossum subsect. Ovata Christ, Monogr. Elaph. 23. 1899.**

Similar to subsect. *Squamipedia*, but the scales of the blade, stipe, and rhizome deeply lacerate-pectinate; phyllopodia distinct; spores with broad folds or ridges but lacking spicules (*Fig. 8*).

TYPE AND SOLE SPECIES: *Acrostichum ovatum* Hook. & Grev. [≡*Elaphoglossum ovatum* (Hook. & Grev.) Moore]. - 22928

---

[3] Although we are basing sect. *Decorata* and subsects. *Squamipedia* and *Muscosa* on Christ's divisions of the same names, some botanists would argue that the cited divisions must have been described in Latin to be valid. Since Christ's descriptions were in German, we here supply Latin descriptions to avoid any confusion.

In frond form and slender rhizome this looks strikingly like *E. squamipes*, but the deeply lacerated scales are quite distinct.

25879 **Elaphoglossum subsect. Feeana Christ, Monogr. Elaph. 22. 1899.**

Fronds linear-lanceolate or oblanceolate, thin, with crenulate margin; phyllopodia short but distinct; spores with crests and sparse to abundant spicules.

TYPE SPECIES: *Acrostichum feei* Bory [≡*Elaphoglossum feei* (Bory) Moore].

OTHER SPECIES EXAMINED: L 25887

Elaphoglossum procurrens (Mett.) Moore and *E. wrightii* (Mett.) Moore.

These species are close to subsect. *Squamipedia* in the very slender, long-creeping rhizome and entire scales, but the thin blade with crenulate margin and spores with narrow ridges or crests distinguish them as a separate group.

25880 **Elaphoglossum sect. Decorata Mickel & Atehortúa, sect. nov.**[3]

Rhizomatis erecti crassi paleae lineares; phyllopodia brevia; stipitis paleae magnae patulae; laminae magnae ellipticae praeter costam marginesque paleis imbricatis aureis vestitas glaberrimae; nervi conspicui hinc inde anastomosantes; hydathodi nulli; sporae breviter cristatae.

TYPE AND SOLE SPECIES: *Acrostichum decoratum* Kunze [≡*Elaphoglossum decoratum* (Kunze) Moore]. L 2245

This species is remarkably distinct and without close relatives.

25881 **Elaphoglossum sect. Lepidoglossa Christ, Monogr. Elaph. 21. 1899.**

25882 Sect. *Gymnoglossa* Christ, Monogr. Elaph. 22. 1899. LECTOTYPE (chosen here): *Osmunda bifurcata* Jacq. [≡*Elaphoglossum bifurcatum* (Jacq.) Mickel]. Christ did not designate a type for sect. *Gymnoglossa*, but he did choose *E. furcatum* (syn. *E. bifurcatum*) as type of his subsect. *Dimorpha*, which is the first named and most typical subsection of sect. *Gymnoglossa*. 9370

Rhizome short- to moderately creeping or ascending; rhizome scales mostly dark, lustrous, entire to toothed; phyllopodia indistinct to distinct; blade often densely scaly over both surfaces, rarely glabrous, scales often lanceolate and toothed, ciliolate or rarely entire, or round-peltate, or modified to stellate hairs; veins evident to obscure, free; hydathodes lacking; spores with low ridges, rarely crested, usually also with small verrucae between the ridges.

LECTOTYPE SPECIES: *Acrostichum paleaceum* Hook. & Grev. [≡*Elaphoglossum* paleaceum (Hook. & Grev.) Sledge] (syn. *Acrostichum squamosum* Swartz ≡*Elaphoglossum squamosum* J. Smith, *nom. superfl.*). Christ cited *E. squamosum* as the type of his division *Auricoma*, the first and most typical division of his subsect. *Polylepidea*, which in turn was the first and most typical subsect. of sect. *Lepidoglossa*. 7198

KEY TO THE SUBSECTIONS OF SECTION LEPIDOGLOSSA

1. Blade densely scaly; scales lanceolate, toothed, not stellate or reduced to resinous dots.
  2. Blade ovate-lanceolate, coriaceous, often obtuse at apex; blade scales erose; spores verruculate. subsect. *Muscosa*
  2. Blade linear-lanceolate or narrowly elliptic, acuminate at apex; blade scales lanceolate, ciliolate; spores with low, non-verruculate ridges. ....subsect. *Polylepidea*
1. Blade glabrous to scaly; blade scales often modified to stellate hairs and/or resinous dots.
  3. Stipe and adaxial blade scales round-peltate. ....subsect. *Microlepidea*
  3. Stipe and adaxial blade scales lanceolate or stellate or lacking.

4. Blade glabrous, elliptic with a caudate apex. ....subsect. *Petioloa*
4. Blade scaly to subglabrous, linear to lanceolate, acuminate to obtuse at apex.
    5. Rhizome short-creeping; blade acute to acuminate, rarely crenulate to pinnately divided. subsect. *Pilosa*
    5. Rhizome long, ascending; blade obtuse. ....subsect. *Huacsaro*

25883 **Elaphoglossum subsect. Polylepidea Christ, Monogr. Elaph. 21. 1899.**

Rhizome short-creeping to ascending; rhizome scales dark, ciliolate; blade scales long-ciliolate; blade narrowly elliptic, densely scaly; spores with low ridges, usually with small verrucae between the ridges (*Fig. 9*).

✓LECTOTYPE SPECIES (chosen here): *Acrostichum paleaceum* Hook. & Grev. [≡*Elaphoglossum paleaceum* (Hook. & Grev.) Sledge]. – 7198

SELECTED SPECIES EXAMINED:

Elaphoglossum acuminans C. Chr. ex Urban, *E. auricomum* (Kunze) Moore, *E. casanense* Rosenst., *E. deckenii* (Kuhn) C. Chr., *E. dombeyanum* Moore & Houlst., *E. eatonianum* (E. Britt.) C. Chr., *E. eggersii* (Baker) Christ, *E. fuertesii* Brause, *E. hyalinum* Christ, *E. kuhnii* Hieron., *E. laminarioides* (Bory) Moore, *E. langsdorfii* (Hook. & Grev.) Moore, *E. meridense* (Klotzsch) Moore, *E. orbignyanum* (Fée) Moore, *E. plumosum* (Fée) Moore, *E. rubescens* (Kuhn) Christ, *E. rufescens* (Liebm.) Moore, *E. vestitum* (Schlecht. & Cham.) Schott ex J. Smith, and *E. wagneri* (Kunze) Moore.

This is one of the two largest, most complex, and unmanageable groups in the genus. The toothed or ciliolate scales on the blade and usually also on the rhizome are the principal distinguishing features.

25884 **Elaphoglossum subsect. Microlepidea Christ, Monogr. Elaph. 22. 1899.**

Rhizome scales linear-lanceolate, entire; blade scales stellate below, round and peltate above; spores with low, smooth ridges.

✓LECTOTYPE SPECIES (chosen here): *Acrostichum tectum* Humb. & Bonpl. ex Willd. [≡*Elaphoglossum tectum* (Humb. & Bonpl. ex Willd.) Moore]. Christ selected this species as type of his div. *Tecta*, which is the first-named and most typical of the divisions under subsect. *Microlepidea*. 7213

OTHER SPECIES EXAMINED: *Elaphoglossum furfuraceum* (Mett.) Christ.

This subsection is very close to subsect. *Pilosa*, but the round, peltate scales are not found in any other group.

25885 **Elaphoglossum subsect. Pilosa Christ, Monogr. Elaph. 23. 1899.**

Microstaphyla Presl, Epim. Bot. 160. 1851.

25886 *Elaphoglossum* subsect. *Dimorpha* Christ, Monogr. Elaph. 22. 1899.

Rhizome short-creeping; rhizome scales usually dark, entire to pinnately divided; blade scales resembling stellate hairs or lanceolate-toothed; blade often with resinous dots; spores with low ridges or narrow crests.

✓LECTOTYPE SPECIES (chosen here): *Acrostichum pilosum* Humb. & Bonpl. ex Willd. [≡*Elaphoglossum pilosum* (Humb. & Bonpl. ex Willd.) Moore]. -7201 *Elaphoglossum pilosum* is the type species of Christ's div. *Grata*, which was the first and most typical division of subsect. *Pilosa*.

SELECTED SPECIES EXAMINED:

Elaphoglossum bifurcatum (Jacq.) Mickel, *E. dimorphum* (Hook. & Grev.) Moore, *E. gratum* (Fée) Moore, *E. lagesianum* Rosent., *E. lepidotum* J. Smith, *E. mathewsii* (Fée) Moore, *E. nervosum* (Bory) Christ, *E. petiolatum* (Swartz) Urban, *E. rosenstockii* Christ, *E. salicifolium* (Willd. ex Kaulf.) Alston, and *E. viscosum* (Swartz) J. Smith.

The degree of scaliness and variation from scales to resinous dots within one species is not well understood. This subsection is very closely allied to subsects. *Huacsaro* and *Microlepidea*, and the demarcation between them is not clear.

Elaphoglossum dimorphum displays an intermediate frond morphology between simple fronds, such as those of *E. nervosum*, and the pinnately dissected fronds of *E. bifurcatum*. All three species occur on St. Helena, and Mickel (1980a) has shown that they differ essentially only in dissection. Whether these are in fact three distinct species or all forms of one species is still a question.

25891

Elaphoglossum subsect. Petiolosa Christ, Monogr. Elaph. 23. 1899.

Rhizome short-creeping; rhizome scales dark, linear, bristle-like; blade elliptic with caudate tip; fertile blade folded; blade scales lanceolate or lacking, occasionally with resinous dots; spores with low ridges. 11606

✓TYPE SPECIES: *Acrostichum petiolosum* Desv. [≡*Elaphoglossum petiolosum* (Desv.) Moore].

OTHER SPECIES EXAMINED: *Elaphoglossum trianae* Christ.

The relationships of this subsection are not clear. The resinous dots are reminiscent of those of subsects. *Pilosa* and *Huacsaro*, the bristle-like rhizome scales are similar to those of some members of subsect. *Hybrida*, and the conduplicate fertile blades are similar to those found in some members of subsect. *Setosa*. The blade shape and spore details are unique.

25892

Elaphoglossum subsect. Huacsaro Mickel & Atehortúa, subsect. nov.

Rhizomata adscendentia longa; rhizomatis paleae fuscae integrae; lamina elliptica, apice obtusa; laminae saepe resinoso-punctatae; paleae lanceolatae denticulatae vel pilis stellatis conspersae; sporae dense spiculatae late cristatae.

✓TYPE SPECIES: *Acrostichum huacsaro* Ruiz [≡*Elaphoglossum huacsaro* (Ruiz) Christ]. 7185

SELECTED SPECIES EXAMINED:

Elaphoglossum alfredii Rosenst., *E. calaguala* (Klotzsch) Moore, *E. ciliatum* (Presl) Moore, *E. dendricola* (Baker) Christ, *E. tenax* Rosenst., and *E. vulcanicum* Christ.

This group probably is closely related to subsect. *Pilosa*, as shown by the scales and resinous dots, but the long ascending rhizome, obtuse blade apex, and the highly spiculate spores are distinctive (*Fig. 10*).

25893

Elaphoglossum subsect. Muscosa Mickel & Atehortúa, subsect. nov.[3]

Rhizomata breviter repentia; phyllopodia nulla; stipites laminaeque dense paleaceae; stipitis paleae latae patulae; lamina anguste elliptica ad lanceolata vel ovato-lanceolata, coriacea, apice plerumque obtusa; paleae saepe cum sporangiis mixtae; sporae verrucosae ecristatae.

✓TYPE SPECIES: *Acrostichum muscosum* Swartz [≡*Elaphoglossum muscosum* (Swartz) Moore]. 7197

SELECTED SPECIES EXAMINED:

Elaphoglossum aschersonii Hieron., *E. bellermannianum* (Klotzsch) Moore, *E. blandum* Rosenst., *E. corderoanum* (Sod.) Christ, *E. decipiens* Hieron., *E. engelii* (Karst.) Christ, *E. lehmannianum* Christ, and *E. plicatum* (Cav.) C. Chr.

Although the scales of *E. engelii* approach those of the subsect. *Polylepidea*, the spores are unique in the genus in having verruculae covering the surface (*Fig. 11*).

25894

Elaphoglossum sect. Polytrichia Christ, Monogr. Elaph. 22. 1899.

Rhizome short-creeping to erect; rhizome scales linear to linear-lanceolate; phyllopodia inconspicuous or lacking; stipe and blade, especially blade midvein and margin, with subulate scales and also bearing minute glandular hairs; hydathodes lacking; spores with low ridges and often small verrucae between them.

LECTOTYPE SPECIES (chosen here): *Acrostichum crinitum* L. [≡*Elaphoglossum crinitum* (L.) Christ]. This was the type of Christ's first-named and most typical subsection, *Hymenodium*. -2244

KEY TO THE SUBSECTIONS OF SECTION POLYTRICHIA

1. Blade broadly elliptic and fleshy; veins netted, obscure............................subsect. *Hymenodium*

1. Blade linear-elliptic, narrowly elliptic, or ovate-lanceolate, subcoriaceous or papyraceous; veins free, usually evident.

   2. Stipe short to long; blade scales dark brown to black, located mostly on the margin and midvein. subsect. *Hybrida*

   2. Stipe nearly lacking; blade scales orange, distributed subuniformly over the blade surfaces. subsect. *Apoda*

25895

Elaphoglossum subsect. Hymenodium (Fée) Christ, Monogr. Elaph. 23. 1899.

Hymenodium Fée, Mém. Fam. Foug. 2: 20. 1845.

Fronds large, fleshy, broadly elliptic; veins obscure, netted; spores with low ridges. -1853

TYPE AND SOLE SPECIES: *Acrostichum crinitum* L. [≡*Elaphoglossum crinitum* (L.) Christ].

Although this is occasionally distinguished as a separate genus, it agrees very closely with subsect. *Hybrida*.

25896 **Elaphoglossum subsect. Hybrida Christ, Monogr. Elaph. 23. 1899.**

Rhizome short-creeping or ascending; stipe long; blade usually papyraceous; blade scales especially on the margin and midvein, black or dark brown; spores with low ridges (*Fig. 12*). -1584

TYPE SPECIES: *Acrostichum hybridum* Bory [≡*Elaphoglossum hybridum* (Bory) Moore].

SELECTED SPECIES EXAMINED:

Elaphoglossum albomarginatum A. Reid Smith, *E. auripilum* Christ, *E. cordifolium* Rosenst., *E. denudatum* (Jenm.) Maxon ex Morton, *E. erinaceum* (Fée) Moore, *E. lindbergii* (Mett.) Rosenst., *E. melanopus* (Kunze) Moore, *E. prestonii* J. Smith, *E. scolopendrifolium* (Raddi) J. Smith, *E. spannagelii* Rosenst., and *E. tambillense* (Hook.) Moore.

This subsection is very complex, and the species limits are not well understood. The variation in rhizome scales is especially perplexing. Most species have linear, orange rhizome scales, and others have bristle-like, maroon scales, but the differences are not always clear-cut. At least two species have a glabrous or subglabrous blade.

This subsection is composed mostly of Christ's "divisio *Melanolepidea*" of ordo *Stenoneura*, since they lack hydathodes. Christ referred subsect. *Hybrida* to ordo *Condyloneura*, although *E. hybridum*, the type species, lacks hydathodes and belongs to div. *Melanolepidea*. All other species Christ included in subsect. *Hybrida* have hydathodes and make up our subsect. *Eximia*.

25897 **Elaphoglossum subsect. Apoda Mickel & Atehortúa, subsect. nov.**

Stipites fere nulli; laminae paleae aurantiacae subulatae, per laminae superficiem regulariter conspersae; sporae breviter cristatae. 2241

TYPE SPECIES: *Acrostichum apodum* Kaulf. [≡*Elaphoglossum apodum* (Kaulf.) Schott ex J. Smith].

OTHER SPECIES EXAMINED:

Elaphoglossum cubense (Mett. ex Kuhn) C. Chr. and *E. siliquoides* (Jenm.) C. Chr.

Members of this subsection closely resemble those of subsect. *Setosa* in their orange to brown subulate blade scales, but seem to belong to sect. *Polytrichia* on the basis of no hydathodes and spores with low ridges and perforated crests. They also differ from sect. *Setosa* in their very short stipes.

25898 **Elaphoglossum sect. Setosa (Christ) Mickel & Atehortúa, stat. nov.**[2]

25899 *Elaphoglossum* subsect. *Setosa* Christ, Monogr. Elaph. 23. 1899.

Rhizome short- to long-creeping or erect; rhizome scales linear; phyllopodia lacking; stipes with minute, erect, glandular hairs; plants mostly small; veins evident, spaced well apart, ending well short of the margin in distinct hydathodes; scales subulate, orange to brown; spores with many low crests and usually with a perforate surface, or not crested and the surface echinate-reticulate. 25581

TYPE SPECIES: *Acrostichum villosum* Swartz [≡*Elaphoglossum villosum* (Swartz) J. Smith].

KEY TO THE SUBSECTIONS OF SECTION SETOSA

1. Rhizome long-creeping; rhizome scales dark brown to black .... subsect. *Alpestria*
1. Rhizome ascending to erect; rhizome scales pale to dark brown.
    2. Blade margin usually crenulate. .... subsect. *Plumierana*
    2. Blade margin entire.
        3. Plants very small (2–15 cm tall); blade spatulate, rarely sublinear; hydathodes inconspicuous. subsect. *Pilosella*
        3. Plants small to medium-sized (5–40 cm tall); blade narrowly elliptic to linear-lanceolate; veins and hydathodes evident. .... subsect. *Setosa*

25899 **Elaphoglossum subsect. Setosa Christ, Monogr. Elaph. 23. 1899.**

Rhizome ascending to erect; blade narrowly elliptic to linear-lanceolate; veins and hydathodes evident; spores with low crests (*Fig. 13*) or spines (*Fig. 14*).

TYPE SPECIES: *Acrostichum villosum* Swartz [≡*Elaphoglossum villosum* (Swartz) J. Smith]. L 25581

SELECTED SPECIES EXAMINED:

Elaphoglossum costaricense Christ, *E. lindenii* (Bory ex Fée) Moore, *E. moritzianum* (Klotzsch) Moore, *E. ocoense* C. Chr., *E. omphalodes* (Fée) Brade, *E. palorense* Rosenst., and *E. setosum* (Liebm.) Moore.

Some other species, such as *E. crinipes* C. Chr., *E. oblanceolatum C. Chr., E. papillosum* (Baker) Christ, and *E. setigerum* (Sod.) Diels, are included here because they look like species of subsect. *Setosa* in their external morphological characters, but they differ significantly in spore architecture. Rather than having crests, their spores are densely covered with short spines whose bases branch to form a reticulum (*Fig. 14*). *Elaphoglossum fluminense* Brade may belong here also. It looks like a slender member of subsect. *Pilosella*, but has perforate spores with very low crests like those of most members of subsect. *Setosa*.

25900

Elaphoglossum subsect. Pilosella Christ, Monogr. Elaph. 23. 1899.

Rhizome erect; scales subulate; hydathodes inconspicuous; plants especially small (2–15 cm tall); spores non-perforate with the ridges low and broad, usually lacking spicules. 7200

TYPE SPECIES: *Acrostichum piloselloides* Presl [≡*Elaphoglossum piloselloides* (Presl) Moore].

OTHER SPECIES EXAMINED:

Elaphoglossum hayesii (Mett.) Maxon, *E. horridulum* J. Smith, *E. jamesonii* (Hook. & Grev.) Moore, *E. pusillum* (Mett.) C. Chr., and *E. spatulatum* (Bory) Moore.

Elaphoglossum horridulum and *E. jamesonii* look like they belong here, but are different in their spores having spicules. This subsection is close to subsect. *Setosa*, although its spores have ridges rather than crests and hardly any are perforate, while the hydathodes are less conspicuous than in subsect. *Setosa*.

25901

Elaphoglossum subsect. Alpestria Mickel & Atehortúa, subsect. nov.

Rhizomata longe repentia; rhizomatis paleae fuscae; phyllopodia inconspicua; nervi raro furcati; hydathodi conspicui; stipitis laminaeque paleae subulatae, raro lanceolatae; paleae inter sporangia nullae; sporae perforatae spiculatae breviter cristatae. 25904

TYPE SPECIES: *Acrostichum alpestre* Gardn. [≡*Elaphoglossum alpestre* (Gardn.) Moore].

OTHER SPECIES EXAMINED:

Elaphoglossum barbae Rosenst., *E. chiapense* A. Reid Smith, *E. hirtipes* (Fée) Brade, and *E. leptophlebium* (Baker) C. Chr.

This subsection is close to subsect. *Setosa* in the subulate scales and perforate spores, but differs in the rhizome scales and habit. *Elaphoglossum yatesii* (Sod.) Christ seems to fit here, except that its blade is densely clothed with lanceolate scales.

25902

Elaphoglossum subsect. Plumierana Mickel & Atehortúa, subsect. nov.

Rhizomata breviter repentia usque erecta; lamina margine crenulata; laminae paleae subulatae aurantiacae; sporae cristatae (*Fig. 15*).

TYPE SPECIES: *Elaphoglossum plumieri* Moore. 17328

OTHER SPECIES EXAMINED:

Elaphoglossum buchii C. Chr., *E. lanceum* Mickel, and *E. smithii* (Baker) Christ.

In their thin, crenulate blades these species resemble somewhat the species of subsect. *Feeana*, but are distinct in rhizome habit, rhizome and blade scales, phyllopodia, and hydathodes. There is considerable spore variation within the few species of this group. *Elaphoglossum lanceum* has highly perforate, lace-like crests, whereas the other species have solid, slender, nonperforate crests.

25903

Elaphoglossum sect. Eximia Mickel & Atehortúa, sect. nov.[2]

Rhizomata breviter repentia vel adscendentia; phyllopodia nulla; stipitis paleae lanceolatae minimae vel saepe subulatae; nervi distantes, angulo 40–60° abeuntes; hydathodi conspicui; laminae paleae sparsae minimae, non subulatae; sporae reticulato-echinatae ecristatae.

TYPE SPECIES: *Acrostichum eximium* Mett. [≡*Elaphoglossum eximium* (Mett.) Christ].

7178

KEY TO THE SUBSECTIONS OF SECTION EXIMIA

1. Blade entire, linear to linear-elliptic; stipe scales subulate. ....subsect. *Eximia*

1. Blade pedately divided; stipe and rhizome scales small, lanceolate. ....subsect. *Cardenasiana*

25907

Elaphoglossum subsect. Eximia Mickel & Atehortúa, subsect. nov.

Lamina integra, linearis vel lineari-elliptica; stipitis paleae subulatae; laminae paleae sparsae minusculae.

7178

TYPE SPECIES: *Acrostichum eximium* Mett. [≡*Elaphoglossum eximium* (Mett.) Christ].

OTHER SPECIES EXAMINED:

Elaphoglossum aubertii (Desv.) Moore, *E. beaurepairii* (Fée) Brade, *E. brachyneuron* (Fée) J. Smith, *E. gracile* (Fée) Christ, *E. lineare* (Fée) Moore, and *E. stenopteris* (Klotzsch) Moore.

In the subulate scales, hydathodes, and reticulate-echinate spores (*Figs. 16* and *17),* this group is similar to some members of subsect. *Setosa* and to some extent to sect. *Undulata*.

25908

Elaphoglossum subsect. Cardenasiana Mickel & Atehortúa, subsect. nov.

A subsect. *Eximia* paleis stipitis rhizomatisque minoribus, rhizomate magis carnoso, laminaque pedatim divisa diversa.

9675

TYPE AND SOLE SPECIES: *Elaphoglossum cardenasii* Wagner.

This species is unique in the genus in its pedately divided fronds, but in other characters shows close relationship to subsect. *Eximia*.

25909

Elaphoglossum sect. Undulata Christ, Monogr. Elaph. 24. 1899.

Rhizome short-creeping to erect; phyllopodia lacking; blade ovate-lanceolate; blade scales subulate to deltate-lanceolate, erose or toothed; hydathodes conspicuous; spores without ridges, openly reticulate-echinate, the spine bases diverging and forming a reticulum occasionally with irregular verrucae or perforated crests (*Fig. 18*).

TYPE SPECIES: *Acrostichum hirtum* Swartz [≡*Elaphoglossum hirtum* (Swartz) C. Chr.] (*syn. E. undulatum* (Willd.) Moore).

OTHER SPECIES EXAMINED:

Elaphoglossum bakeri (Sod.) Christ, *E. boryanum* (Fée) Moore, and *E. proliferans* Maxon & Morton ex Morton.

This subsection is closely related to subsect. *Setosa* and possibly to subsect. *Eximia*, with which it has subulate scales and echinate spores in common.

Elaphoglossum castaneum (Baker) Diels is similar to *E. hirtum* in size and shape and in spores with very small, crest-like projections perforate at the base (*Fig. 18*). This could represent a condition intermediate between sects. *Undulata* and *Setosa*, but the rhizome is longer-creeping, the rhizome scales are small, sclerotic, and resinous, and blade scales are lacking.

25910

Elaphoglossum sect. Amygdalifolia (Christ) Mickel & Atehortúa, stat. nov.

25911

Elaphoglossum subsect. *Amygdalifolia* Christ, Monogr. Elaph. 22. 1899.

Rhizome very long-creeping, slender; phyllopodia short; rhizome scales round to ovate, peltate; blades linear-lanceolate; veins evident; hydathodes conspicuous; blade subglabrous with minute stellate hairs; spores with narrow crests with minute spicules.

TYPE AND SOLE SPECIES: *Acrostichum amygdalifolium* Mett. [≡*Elaphoglossum amygdalifolium* (Mett.) Christ]. — 7849

This species is quite distinct and has no close relatives.

ACKNOWLEDGMENTS

This study was supported by National Science Foundation grant DEB 77-25582 to the senior author. We gratefully acknowledge the kind help of Dr. Rupert Barneby for his assistance with the latin and his criticism of the manuscript, Mr. Joel Huang for his technical work with the scanning electron microscope and for preparing the photographs, and Drs. Arthur Cronquist and David Lellinger for nomenclatural advice.

LITERATURE CITED

ALSTON, A. H. G. 1956a. The Brazilian species of Elaphoglossum. Bol. Soc. Brot. 32:1–32.

———. 1956b. The subdivision of the Polypodiaceae. Taxon 5:23–25.

CHRIST, H. 1899. Monographie des Genus Elaphoglossum. Neue Denkschr. Allg. Schweiz. Naturf. Ges. Gesammten Naturwiss. 36:1–159, *t.1–4*.

CHRISTENSEN, C. 1938. Filicinae. *In* F. Verdoorn. Manual of Pteridology. Nijhoff, The Hague.

CRABBE, J. A., A. C. JERMY, and J. T. MICKEL. 1975. A new generic sequence for the pteridophyte herbarium. Fern Gaz. 11:141–162.

DIELS, L. 1899. Polypodiaceae. *In* A. Engler & K. Prantl. Die Natürlichen Pflanzenfamilien 1(4):139–339.

ERDTMAN, G. 1957. Pollen and Spore Morphology/Plant Taxonomy. Almqvist & Wiksells, Uppsala, Sweden.

FÉE, A. L. A. 1845. Histoire des Acrostichées. (Mém. Fam. Foug. 2.) Veuve Berger-Levrault, Strasbourg.

———. 1852. Genera Filicum. (Mém. Fam. Foug. 5.) Veuve Berger-Levrault, Paris & Strasbourg.

GÓMEZ, L. D. 1975. Contribuciones a la pteridologia costarricense. VI. El género Peltapteris Link en Costa Rica. Brenesia 6:25–31.

HENNIPMAN, E. 1977. A monograph of the fern genus Bolbitis (Lomariopsidaceae). Leiden Bot. Ser. 2:1–331.

HOLTTUM, R. E. 1947. A revised classification of leptosporangiate ferns. J. Linn. Soc., Bot. 51:123–158.

———. 1978. Elaphoglossum. Flora Malesiana II, 1(4):289–314.

LIEW, F. S. 1977. Scanning electron microscopical studies on the spores of pteridophytes. XI. The family Oleandraceae (Oleandra, Nephrolepis, and Arthropteris). Gard. Bull. Singapore 30:101–110, *t.I–VI*.

LINK, H. F. 1841. Filicum Species in Horto Regio Botanico Berolinensis Cultae. Veit, Berlin.

LINNAEUS, C. 1753. Species Plantarum, vol. 2. Salvi, Stockholm.

LLOYD, R. M. 1970. A survey of some morphological features of the genus Elaphoglossum in Costa Rica. Amer. Fern J. 60:73–83.

MICKEL, J. T. 1980a. Relationships of the dissected elaphoglossoid ferns. Brittonia 32:109–117.

———. 1980b. Elaphoglossum. *In* R. G. Stolze. Ferns and Fern Allies of Guatemala. Fieldiana, Bot. 39: in press.

MOORE, T. 1857–1862. Index Filicum. Pamplin, London.

MORTON, C. V. 1955. Notes on Elaphoglossum, III. The publication of Elaphoglossum and Rhipidopteris. Amer. Fern. J. 45:11–14.

PICHI SERMOLLI, R. E. G. 1968. Adumbratio Florae Aethiopicae. 15. Elaphoglossaceae. Webbia 23:209–246.

PRESL, C. B. 1851. Epimiliae Botanicae. Abh. Königl. Böhm. Ges. Wiss. V, 6:361–624.

SCHELPE, E. A. C. L. E. 1969. Reviews of tropical African Pteridophyta, 1. Contr. Bolus Herb. 1:1–132.

SCHOTT, H. 1834. Genera Filicum. Wallishausser, Vienna.

SLEDGE, W. A. 1967. The genus Elaphoglossum in the Indian peninsula and Ceylon. Bull. Brit. Mus. (Nat. Hist.), Bot. 4:79–96.

SMITH, J. 1841. An arrangement and definition of the genera of ferns, with observations on the affinities of each genus. J. Bot. (Hook.) 4:38–70, 147–198.

SODIRO, A. 1897. Cryptogamae Vasculares Quitenses. Typis Universitatis, Quito.

SPORNE, K. R. 1975. The Morphology of Pteridophytes, ed. 4. Hutchinson, London.

WAGNER, W. H., Jr. 1954. A Bolivian Elaphoglossum of unique leaf structure. Bull. Torrey Bot. Club 81:61–67.

REVIEW

"HOW TO KNOW THE FERNS AND FERN ALLIES," by John T. Mickel, 1979. Wm. C. Brown Company Publishers, Dubuque, Iowa. $7.95 hardcover, $5.95 wire coil bound.—In the standard format of the Pictured Key Nature Series, this book provides the information needed to identify North American ferns and fern allies. Introductory chapters on structure, life history, hybridization, cultivation, collection, and nomenclature provide a basic understanding of ferns and fern allies and the terminology needed to identify these plants successfully. This also makes the work useful as a textbook or handbook for amateur pteridologists.

The greatest part of the volume consists of bracketed keys which lead the user to the appropriate genus and species. Diagnostic characters for each species, provided in the annotated keys, are supplemented by a brief description, habitat preference, frequency of occurrence, and distribution map, as well as an illustration for nearly every species. Limited synonymy is also included. Hybrids and infraspecific taxa are mentioned with related species. Problems in taxonomy are explained so that the basis for confusion can be understood. The genera are listed alphabetically, enabling the experienced pteridologist to turn to the appropriate genus and begin keying at that point. The uninitiated can begin with the generic key that is found near the beginning of the book. Edgar Paulton's line drawings are quite good and in general capture the distinguishing characteristics of each species. The book concludes with a listing of state and regional identification manuals, a checklist of North American (United States and Canada) ferns and fern allies, and an index which includes a glossary.

The information contained in this volume is presented in a clear and concise manner using currently accepted taxonomy and nomenclature. Anyone who has an interest in North American ferns or fern allies should have a copy of this book. Dr. Mickel is to be congratulated for condensing and synthesizing a great amount of information into the kind of reasonably priced book amateur and professional pteridologists alike have long awaited.—*W. Carl Taylor, Department of Botany, Milwaukee Public Museum, Milwaukee, WI 53233.*